Airborne
Synthetic Aperture Radar
(SAR)

Support Data Extensions (SDE)

for the

National Imagery Transmission Format (Version 2.0)

of the

National Imagery Transmission Format Standards

20 May 1996

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1.0 SCOPE

1.1 Scope.

This appendix specifies the format and content of a set of controlled tagged record extensions for the NITF 2.0 file format. The specified tagged records incorporate all Support Data Extensions relevant to primary imagery processed from Synthetic Aperture Radar (SAR) data. The information which makes up the SDE is derived from referenced interface documents. Systems using SAR imagery formatted according to NITF 2.0 should be designed to extract the needed data from the tagged records described herein. Raw SAR data is in the form of complex video phase history which must be processed in order to form an image. It is the processed imagery, not video phase history, that is stored in the NITF 2.0 file format.

1.2 Content.

This appendix provides a detailed description of the overall structure, as well as specification of the valid data content and format, for all fields defined within each specified SDE. In addition, technical information is presented to provide a general understanding of the significance of the included fields.

1.3 Applicability.

The applicability of this appendix is inherited from the NITF 2.0 standard. It is applicable to all Department of Defense new equipment and systems, and those undergoing major modification, having a requirement to support SAR imagery. These systems shall conform to the NITF 2.0 standard, including the SDEs described in this appendix.

1.4 Certification.

Pertinent compliance requirements are defined in Joint Interoperability Engineering Organization (JIEO) Circular 9008, National Imagery Transmission Format Certification Test and Evaluation Plan.

2.0 APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards and handbooks The following standards form a part of this document to the extent specified. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS).

MILITARY STANDARDS

MIL-STD-2500A	National Imagery Transmission Format (NITF) for the National Imagery Transmission Format Standards (NITFS), 12 October 1994.

(Copies of the above NITFS document may be obtained from DODSSP, Subscription Services Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094, telephone (215) 697-2569.)

MILITARY HANDBOOKS

MIL-HDBK-1300	National Imagery Transmission Format Standard (NITFS) Handbook, 30 June 1993.

(Copies of the above NITFS document may be obtained from DODSSP, Subscription Services Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094, telephone (215) 697-2569.)

2.1.2 Other Government documents, drawings, and publications.

The following other Government documents form a part of this document to the extent specified. Unless otherwise specified, the issues of these documents are those cited in the solicitation.

DISA/JIEO Circular 9008	NITFS Certification Test and Evaluation Program Plan

(Copies of the above NITFS document may be obtained from Joint Interoperability Test Center, Attn: TCDBA, Bldg 57305, Ft, Huachuca, AZ 85613-7020, telephone (602) 538-5154.)

ICD40020-641	TRAC-MIES Interface Control Document , 15 May 1995
IFS-DGS-450 IFS-DGS-D5	Interface Specification ASARS Processing Segment To Mission Intelligence Segment (MIS) (S) 15 September 1992
IFS-TREDS-0007	ASARS Deployable Processing Station (ADPS) to ASARS Exploitation Cell Interface Spec. (S) 07 June 1982
ATL-00726-94	ETRAC/MCP Output Plane Definitions (S)
CIO-2047	Support Data Extensions (version 1.1) for the National Imagery Transmission Format (Version 2.0) of the National Imagery Transmission Format Standard (TS) 15 April 1995

2.2 Non-Government publications.

The following documents form a part of this document to the extent specified. Unless otherwise specified, the issues of the documents that are adopted by the DOD are those listed in the issue of the DODISS cited in the solicitation.

INTERNATIONAL STANDARDS

None.

NATIONAL STANDARDS

ANSI X3.4 - 1986	American National Standard Code for Information Interchange (ASCII), 1986.

(Copies of the above document are available from American National Standards Institute (ANSI) Sales Department, 1430 Broadway, New York, NY 10018, telephone: (212) 642-4900.)

3.0 DEFINITIONS

3.1 Acronyms

Field Names and Values contained in the various tables of this document are not replicated in this list.

A/C	Aircraft
ANSI	American National Standards Institute
ARP	Aircraft Reference Point
ASCII	American National Standard Code for Information Interchange
ASARS	Advanced Synthetic Aperture Radar System
BE	Basic Encyclopedia
CCRP	Collection Central Reference Point
DODIIS	Department of Defense Intelligence Information System
ECF	Earth Centered Fixed Coordinate System
ETRAC	Enhanced Tactical Radar Correlator
FPN	Focus Plane Normal Vector
FTI	Fixed Target Indication
GMT	Greenwich Mean Time
ID	Identification
INS	Inertial Navigation System
IPR	Impulse Response
JIEO	Joint Interoperability Engineering Organization
MIES	Modernized Imagery Exploitation System
MSL	Mean Sea Level
MTI	Moving Target Indication
NED	North East Down Coordinate System
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standards
ORP	Output Reference Point
RCS	Radar Cross Section
RGM	Mid-Array Ground Plane Range
RSM	Mid-Array Slant Plane Range
SAR	Synthetic Aperture Radar
SDE	Support Data Extension
TRAC	Tactical Radar Correlator
WAMTI	Wide Area Moving Target Information

4.0 GENERAL REQUIREMENTS

4.1 Support Data Extensions (SDEs).

That set of support data needed to accomplish the mission of a system receiving a NITF 2.0 file is referred to as "appropriate" support data. The appropriate support data may vary across systems receiving NITF 2.0 files. A system receiving a NITF 2.0 file may add or subtract support data before passing the file to another system with a different mission. This strategy implies a modular support data definition approach.

4.1.1 Sources of support data.

Image providers produce NITF 2.0 files with support data from other formats which also contain support information. The extensions described here define the format for that support information within a NITF 2.0 file containing SAR imagery.

4.1.2 Defined Support Data Extensions.

Table 1 lists all the SDEs that are defined for use with processed SAR imagery. Several are similar to existing and proposed extensions developed by other, related, programs, and can be considered aliases to those extensions. Reserved data fields maintain alignment between the original and aliased extensions where original fields are not applicable to SAR imagery.

Each tag ends with the letter "A". Revised tags will have names ending in "B" ("C","D", etc.) as revisions are approved. A transition plan for implementing tag changes shall accompany any such revisions. Typically, both the "A" and "B" versions should be supported by receivers of NITF products for some reasonable period of time.

Table 1. SAR Related Support Data Extensions

AIMIDA	Additional Image Identification
EXPLTA	Exploitation Related Information
BLOCKA	Image Block Information
SECTGA	Secondary Targeting Info
MPDSRA	Mensuration Data
MENSRA	Airborne SAR Mensuration Data
ACFTA	Aircraft Information
PATCHA	Patch Information
MTIRPA	Moving Target Information Report

4.2 Technical Notes on Coordinate Systems

The historic coordinate system for synthetic aperture radar is a left to right, bottom up system. When mapping on the right side of the aircraft, the first pixel of each scan line is at minimum range with subsequent pixels at increasing range; when mapping on the left side, the first pixel of each scan line is at maximum range with subsequent pixels at decreasing range. See figure 1.

The NITF coordinate system is a left to right, top to bottom, coordinate system. Column numbers increase to the right, and row numbers increase downwards. The first pixel within a block is at the upper left, with subsequent pixels to the right along the row, until the last pixel of a row is

followed by the left-most pixel of the next lower row. See figure 2. Note: The SAR image depiction in Figure 2 is oriented 180° from Figure 1, with the oldest line at the top (i.e., the sensor is flying toward the bottom of the figure).

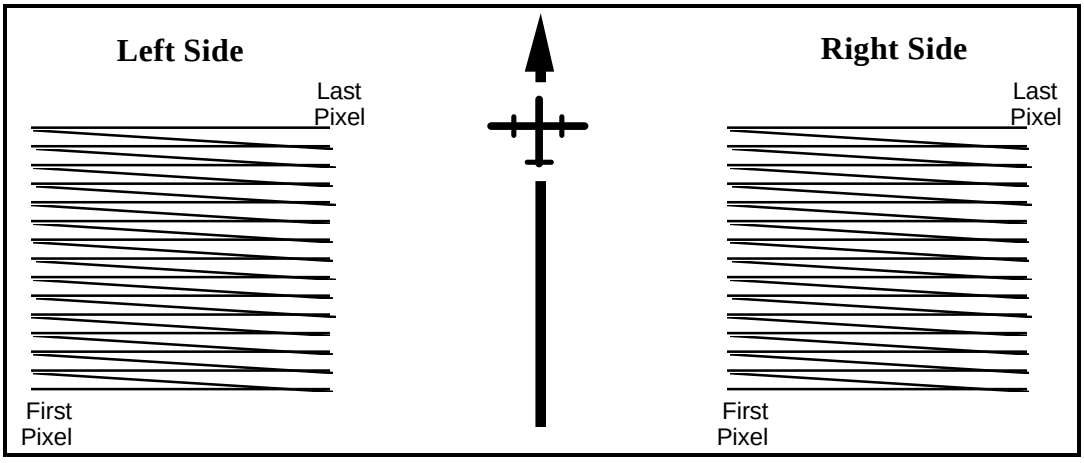

Figure 1. SAR Scanning Patterns

The order of pixels within each image row must be reversed before a SAR image is imbedded within a NITF file in order to prevent a mirrored view of the scene from being displayed on NITF screens.

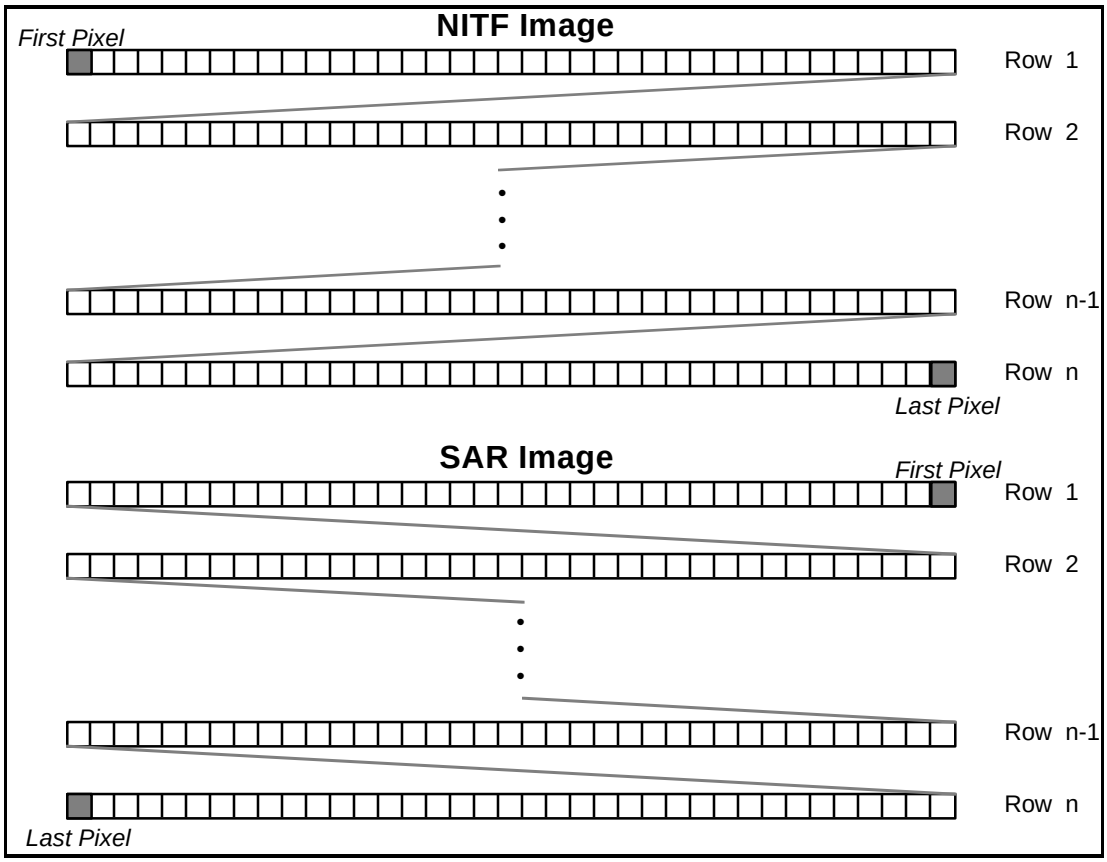

Figure 2. SAR and NITF Coordinate Systems

5.0 DETAILED REQUIREMENTS

5.1 Generic Tagged Extension Mechanism

The tagged record extensions defined in this document are "controlled tagged record extensions" as defined in Section 5.9 of the NITF 2.0 standard. The tagged record extension format is summarized here for ease of reference. Tables 2 and 3 describe the general format of a controlled tagged record extension.

Table 2. Controlled tagged record extension format

(R) = required, (O) = optional, and (C) = conditional

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique extension type identifier	6	Alphanumeric	n/a	R
CEL	Length of CEDATA field	5	00001 to 99988	Bytes	R
CEDATA	User-defined data	*	User-defined	n/a	R

* equal to value of CEL field.

Table 3. Controlled tagged record extension field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CETAG	This field shall contain a valid alphanumeric identifier properly registered with the NITF Technical Board.
CEL	This field shall contain the length in bytes of the data contained in CEDATA. The tagged record's length is 11 + the value of CEL.
CEDATA	This field shall contain data primarily of character data type (binary data is acceptable for extensive data arrays, such as color palettes or look-up tables) defined by and formatted according to user specification. The length of this field shall not cause any other NITF field length limits to be exceeded but is otherwise fully user defined.

The CETAG and CEL fields essentially form a small (11 byte) tagged record subheader. The format and meaning of the data within the CEDATA field is the subject of this document for several, individual controlled tagged record extensions.

Multiple tagged extensions can exist within the tagged record extension area. There are several such areas, each of which can contain 99,999 bytes worth of tagged extensions. There is also an overflow mechanism, should the sum of all tags in an area exceed 99,999 bytes. The overflow mechanism allows for up to 1 Gbyte of tags.

While the extensions defined in this document will typically be found in the image subheader, it is possible that they could appear in a Data Extension Segment which is being used as an overflow of the image subheader.

If the information contained within an extension is not available, the extension will not be present in the file. For example, if no moving target information is available, no MTIRPA extensions will be present. The set of extensions stored within the file can change over the lifetime of the image, due to additional information or removal of outdated information. For example, moving target information may be of fleeting value, while the image depicting them may be archived for future reference; the MTIRPA extensions can be removed before archiving without damaging the remaining information. When an extension is present, all of the information listed as Required

must be filled in with valid information. Information listed as Optional (type = O) may contain valid information, or may contain ASCII spaces to indicate that valid data is unavailable. Reserved fields support applications beyond the scope of this document, and normally contain spaces where no value is explicitly specified; however, other values are possible.

5.1.1 AIMIDA — Additional Image ID

The Additional Image ID tag is intended to be the most basic support data extension for SAR imagery, and is a prerequisite for all other tags defined in this document. The format for the user defined fields of the AIMIDA extension is detailed in Table 4, and the descriptions of these fields is detailed in Table 5. A single AIMIDA is placed in the Image Subheader. Where several Image Subheaders relate to a single scene, AIMIDA is placed in the first Image Subheader.

Table 4. AIMIDA — Additional Image ID extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	AIMIDA	n/a	R
CEL	Length of Entire Tagged Record	5	00069	Bytes	R
The following fields define AIMIDA					
MISSION_DATE	Aircraft T.O. Date	7	DDMonYY		R
MISSION_NO	Mission ID	4	0000 to 9999		R
FLIGHT_NO	Flight No.	2	01 to 09, A1 to A9 B1 to B9 … Z1 to Z9		R
OP_NUM	Image Operation No.	3	001 to 999		R
	reserved	2	spaces		R
REPRO_NUM	Reprocess No.	2	00 to 99		R
REPLAY	Retransmission No.	3	000, T01 to T99, G01 to G99, P01 to P99		R
	reserved	1	space		R
START_COLUMN	Block No.	2	01 to 27		R
START_ROW	"	5	00001 to 99999		R
	reserved	2	spaces		R
END_COLUMN	Block No.	2	01 to 27		R
END_ROW	"	5	00001 to 99999		R
COUNTRY	Country Code	2	AA to ZZ		O
	reserved	4	spaces		R
LOCATION	Latitude and longitude	11	ddmmXdddmmY		R
TIME	Time of First Line	5	hhmmZ		R
CREATE_DATE	Date of First Line	7	DDMonYY		R

Table 5. AIMIDA — Additional Image ID field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
MISSION_DATE	This field shall contain the date of the collection mission (date of aircraft takeoff) in the format DDMonYY, in which DD is the day of the month (00-31), Mon is the first three characters of the month (JAN – DEC), and YY is the last two digits of the year (00 – 99).
MISSION_NO	Four digit descriptor of the mission.
FLIGHT_NO	Each flight shall be identified by a flight number in the range 01 to 06. Flight 01 shall be the first flight of the day, flight 02 the second, etc. In order to ensure uniqueness in the image id, if the aircraft mission extends across midnight GMT, the flight number shall be 0x (where x is in the range 0 to 6) on images acquired before midnight GMT and Ax on images acquired after midnight GMT; for extended missions Bx, … Zx shall designate images acquired on subsequent days.
OP_NUM	Imaging operation number. Reset to 1 at the start of each flight.
REPRO_NUM	Reprocess Number indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A "00" in this field indicates that the data is an originally processed image, a range of "01" to "99" indicates the data is reprocessed.
REPLAY	Replay indicates whether the data was retransmitted to overcome reception errors. A "00" in this field indicates that the data is from an original transmission, a value in the range of "T01" to "T99" indicates the data was retransmitted. Values in the range of "G01" to "G99" and "P01" to "P99" are reserved for possible future implementation.
START_COLUMN	Starting column Block No. (cross scan direction).
START_ROW	Starting row Block No. (along scan direction).
END_COLUMN	Ending column Block No. (cross scan direction).
END_ROW	Ending row Block No. (along scan direction).
COUNTRY	Two letter code defining the country for the reference point of the image segment.
LOCATION	Location of the center of the first image block, provides rough indication of geographic coverage. The format ddmmX represents degrees (00-89) and minutes (00-59) of latitude, with X = N or S for north or south, and dddmmY represents degrees (000-179) and minutes (00-59) of longitude, with Y = E or W for east or west, respectively.
TIME	This field shall contain the collection time referenced to GMT, and accurate to 1 minute, of the first line of the image in the format hhmmZ, in which hh is the hour (00-23), and mm is the minute (00-59); the final character "Z" is required.
CREATE_DATE	This field shall contain the collection date of the first line of the image in the format DDMonYY, in which DD is the day of the month (00-31), Mon is the first three characters of the month (JAN – DEC), and YY is the last two digits of the year (00 – 99). This date is coordinated with the collection time, i.e., the date changes at midnight GMT.

5.1.2 EXPLTA — Exploitation Related Information

The format for the user defined fields of the EXPLTA extension is detailed in Table 6, and the descriptions of these fields is detailed in Table 7. A single EXPLTA is placed in the Image Subheader, following AIMIDA.

Table 6. EXPLTA — Exploitation Related Information extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	EXPLTA	n/a	R
CEL	Length of Entire Tagged Record	5	00087	Bytes	R
The following fields define EXPLTA					
ANGLE_TO_NORTH	Angle to True North	3	000 to 359	degrees	R
SQUINT_ANGLE	Squint Angle	3	± 60	degrees	R
MODE	Imaging Mode	3	xSP,xGP,xES,yyS		R
	reserved	16	spaces		R
GRAZE_ANG	Focus plane grazing angle	2	00 to 90	degrees	R
SLOPE_ANG	Focus plane slope angle	2	00 to 90	degrees	R
POLAR	Polarization	2	HH, HV, VH, VV		R
NSAMP	Pixels per Line	5	00001 to 99999		R
	reserved	1	0		R
SEQ_NUM	Sequence within Coupled Imagery Set	1	1 to 6		O
PRIME_ID	ID of Primary Target	12	Alphanumeric		O
PRIME_BE	BE of Primary Target	15	Alphanumeric		O
	reserved	1	0		R
N_SEC	No. of Secondary Targets*	2	00 to 10		O
IPR	Commanded IPR**	2	00 to 99	ft.	O
	reserved	2	01		R
	reserved	2	spaces		R
	reserved	5	00000		R
	reserved	8	spaces		R

* determines no. of SECTGA extensions
**replicated in each MPDSRA extension

Table 7. EXPLTA — Exploitation Related Information field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
ANGLE_TO_NORTH	Angle measured clockwise in degrees from first row of the image to True North.
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from 0 (broadside) to +60 degrees; aft looking squint angles range from 0 to -60 degrees.
MODE	Mode represents both the collection mode and the processing mode. For Spot imagery the first character indicates the collection mode with "1" for either SPOT 1 Mode, and "3" for SPOT 3 Mode; the second and third characters indicate the processing (sampling) mode: "SP" = Slant Plane, "GP" = Ground Plane, and "ES" = Enhanced Spot. For Search mode imagery the first two characters yy represent the nominal impulse response, and the third character is "S."
GRAZE_ANG	The angle measured in degrees at the target, between the focus plane and line of sight to the radar.
SLOPE_ANG	Given GRAZE_ANG y and SQUINT_ANGLE q, $SLOPE\_ANG = \cos^{-1}\left[\frac{\cos y \cos q}{\sqrt{\left(\sin^2 y \sin^2 q + \cos^2 q\right)}}\right]$ Note: SLOPE_ANG is equal to GRAZE_ANG for broadside mapping (q = 0).
POLAR	The first character indicates the nominal transmit polarization, and the second character indicates the nominal receive polarization. Each can be Horizontal (H) or Vertical (V).
NSAMP	Pixels per Line (includes fill)
SEQ_NUM	Sequence within Coupled Imagery Set
PRIME_ID	Target Designator of primary target
PRIME_BE	Basic Encyclopedia ID of the primary target
N_SEC	Number of secondary targets in image
IPR	Commanded impulse response.

5.1.3 BLOCKA — Image Block Information

The format for the user defined fields of the BLOCKA extension is detailed in Table 8, and the descriptions of these fields is detailed in Table 9. BLOCKA is placed in the Image Subheader. Where several Image Subheaders relate to a single scene BLOCKA is placed in the first Image Subheader.

Table 8 BLOCKA — Image Block Information extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	BLOCKA	n/a	R
CEL	Length of Entire Tagged Record	5	00123	Bytes	R
The following fields define BLOCKA					
BLOCK_INSTANCE	Block number	2	01 to 99		R
N_GRAY	No. of gray fill samples	5	00000 to 99999		R
L_LINES	Line Count	5	00001 to 99999		R
LAYOVER_ANGLE	Radar Layover Angle	3	000 to 359	degrees	O
SHADOW_ANGLE	Radar Shadow Angle	3	000 to 359	degrees	O
	reserved	16	spaces		O
FRLC_LOC	First Row Last Column Location	21	Xddmmss.ssYdddmmss.ss		R
LRLC_LOC	Last Row Last Column Location	21	Xddmmss.ssYdddmmss.ss		R
LRFC_LOC	Last Row First Column Location	21	Xddmmss.ssYdddmmss.ss		R
FRFC_LOC	First Row First Column Location	21	Xddmmss.ssYdddmmss.ss		R
	reserved	5	010.0		R

Table 9 BLOCKA — Image Block Information field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
BLOCK_INSTANCE	Block number of this image block,
N_GRAY	No. of gray Fill samples
L_LINES	Line Count
LAYOVER_ANGLE	The angle between the first row of pixels and the layover direction in the image; positive values indicate a clockwise direction.
SHADOW_ANGLE	The angle between the first row of pixels and the radar shadow in the image; positive values indicate a clockwise direction.
FRLC_LOC LRLC_LOC LRFC_LOC FRFC_LOC	Latitude and longitude at the first row, last column of the image block. Latitude and longitude at the last row, last column of the image block. Latitude and longitude at the last row, first column of the image block. Latitude and longitude at the first row, first column of the image block. The format Xddmmss.ss represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X = N for north or S for south, and Ydddmmss.ss represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y = E for east or W for west. These locations, at lower precision, are also contained in IGEOLO of the image subheader.

5.1.4 SECTGA — Secondary Targeting Information

The format for the user defined fields of the SECTGA extension is detailed in Table 10, and the descriptions of these fields is detailed in Table 11. As many as ten SECTGA extensions can exist in a single NITF file, with the N_SEC field of EXPLTA providing the total count. Either SEC_ID, SEC_BE, or both, must contain a valid identifier.

Table 10 SECTGA — Secondary Targeting Information extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	SECTGA	n/a	R
CEL	Length of Entire Tagged Record	5	00028	Bytes	R
The following fields define SECTGA					
SEC_ID	ID of Secondary Target	12	Alphanumeric		O
SEC_BE	BE of Secondary Target	15	Alphanumeric		O
	reserved	1	0		R

Table 11 SECTGA — Secondary Targeting Information extension format

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
SEC_ID	Designator of secondary target
SEC_BE	Basic Encyclopedia ID of secondary target

5.1.5 MPDSRA — Mensuration Data

The format for the user defined fields of the MPDSRA extension is detailed in Table 12, and the descriptions of these fields is detailed in Table 13.

Table 12 MPDSRA — Mensuration Data extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MPDSRA	n/a	R
CEL	Length of Entire Tagged Record	5	00188	Bytes	R
The following fields define MPDSRA					
BLK_NUM	Image block number	2	01 to 99		R
IPR	Commanded IPR	2	01 to 99	ft.	R
NBLKS_IN_WDG	Number of image blocks in WDG	2	01 to 99		R
ROWS_IN_BLK	Number of rows in image block	5	00001 to 99999		R
COLS_IN_BLK	Number of columns in image block	5	00001 to 99999		R
ORP_X	Output Reference Point (ECF)	9	± 99999999	ft.	O
ORP_Y	"	9	± 99999999	ft.	O
ORP_Z	"	9	± 99999999	ft.	O
ORP_ROW	Row Containing ORP	5	00001 to 13600		O
ORP_COLUMN	Column Containing ORP	5	00001 to 16384		O
FOC_X	Focus Plane Normal Vector	7	± 1.0000		O
FOC_Y	"	7	± 1.0000		O
FOC_Z	"	7	± 1.0000		O
ARP_TIME	Collection Start Time (GMT)	9	00000.000 to 86399.999	seconds	R
	reserved	14	spaces		R
ARP_POS_N	Aircraft Location,	9	± 99999999	ft.	R
ARP_POS_E	"	9	± 99999999	ft.	R
ARP_POS_D	"	9	± 99999999	ft.	R
ARP_VEL_N	Aircraft Velocity	9	± 99999.99	ft/sec	R
ARP_VEL_E	"	9	± 99999.99	ft/sec	R
ARP_VEL_D	"	9	± 99999.99	ft/sec	R
ARP_ACC_N	Aircraft Acceleration	8	± 100.000	ft/sec^2	R
ARP_ACC_E	"	8	± 100.000	ft/sec^2	R
ARP_ACC_D	"	8	± 100.000	ft/sec^2	R
	reserved	13	000.0000001.0		R

Table 13 MPDSRA — Mensuration Data field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
BLK_NUM	Image block number in which the Output Reference Point occurs.
IPR	Commanded IPR
NBLKS_IN_WDG	Total number of image blocks in the file.
ROWS_IN_BLK	Number of rows in image block
COLS_IN_BLK	Number of columns in image block
ORP_X ORP_Y ORP_Z	X, Y, and Z components of Output Reference Point (ORP) position vector in Earth Centered Fixed (ECF) coordinate system.
ORP_ROW	Row containing ORP
ORP_COL	Column containing ORP
FOC_X FOC_Y FOC_Z	X, Y, and Z components of Focal Plane Normal (FPN) Vector in Earth Centered Fixed (ECF) coordinate system.
ARP_TIME	Collection Start Time in seconds past midnight GMT
ARP_POS_N ARP_POS_E ARP_POS_D	The Aircraft Reference Point position at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the CCRP for the SPOT modes.
ARP_VEL_N ARP_VEL_E ARP_VEL_D	The Aircraft Reference Point velocity at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the CCRP for the SPOT modes.
ARP_ACC_N ARP_ACC_E ARP_ACC_D	The Aircraft Reference Point acceleration at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the CCRP for the SPOT modes.

5.1.6 MENSRA — Airborne SAR Mensuration Data

The format for the user defined fields of the MENSRA extension is detailed in Table 14, and the descriptions of these fields is detailed in Table 15.

Table 14. MENSRA — Airborne SAR Mensuration Data extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MENSRA	n/a	R
CEL	Length of Entire Tagged Record	5	00155	Bytes	R
The following fields define MENSRA					
Collection Central Reference Point (CCRP):					
CCRP_LOC	CCRP Location	21	ddmmss.ssXdddmmss.ssY		R
CCRP_ALT	CCRP Altitude	6	-01000 to +30000	ft	R
OF_PC_R	Offset Between CCRP And Patch Center, Range	7	±2000.0	ft	R
OF_PC_A	Offset Between CCRP And Patch Center, Azimuth	7	±2000.0	ft	R
COSGRZ	Cosine of Grazing Angle	7	0.00000 to 1.00000		R
RGCCRP	Range to CCRP	7	0000000 to 3000000	ft	R
RLMAP	Right/Left	1	L or R		R
CCRP_ROW	CCRP row number	5	00000 to 13600		R
CCRP_COL	CCRP column number	5	00000 to 16384		R
Aircraft Position:					
ACFT_LOC	Aircraft Location	21	ddmmss.ssXdddmmss.ssY		R
ACFT_ALT	Aircraft Altitude	5	00000 to 99999	ft	R
CCRP Unit Basis Vector:					
C_R_NC	Range Unit Vector, North	7	±1.0000		R
C_R_EC	Range Unit Vector, East	7	±1.0000		R
C_R_DC	Range Unit Vector, Down	7	±1.0000		R
C_AZ_NC	Azimuth Unit Vector, North	7	±1.0000		R
C_AZ_EC	Azimuth Unit Vector, East	7	±1.0000		R
C_AZ_DC	Azimuth Unit Vector, Down	7	±1.0000		R
C_AL_NC	Altitude: North Component	7	±1.0000		R
C_AL_EC	Altitude: East Component	7	±1.0000		R
C_AL_DC	Altitude: Down Component	7	±1.0000		R

Table 15. MENSRA — Airborne SAR Mensuration Data field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
Collection Central Reference Point (CCRP):	
CCRP_LOC CCRP_ALT	In the Search mode, the airborne system chooses a Collection Central Reference Point (CCRP) along the scene center line for each patch. The CCRP will be near the patch line center. In the Spot Mode, the CCRP is in the exact center of the scene. The format ddmmss.ssX represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y = E for east or W for west. The CCRP altitude is the altitude in feet of the CCRP above mean sea level (MSL).
OF_PC_R OF_PC_A	In the Search mode the airborne system chooses a Collection Central Reference Point (CCRP) along the scene center line for each patch. The patch center (PC), the actual , geometric center of the processed imagery, is offset from the CCRP along the scene center line. The range and azimuth offsets are given in feet. Increasing range is positive. Azimuth in the direction which subtends an acute angle with the directed scene track is positive. In the Spotlight mode, the patch center is the CCRP, therefore, the offsets are both equal to 0.
COSGRZ	Cosine of the Graze Angle is computed by dividing the ground plane range of the CCRP to the antenna at mid collection array (RGM) by the slant range of the CCRP to the antenna at mid array (RSM). cos (y) = RGM/RSM
RGCCRP	Estimated slant range in feet from the antenna at mid collection array to the CCRP.
RLMAP	This field indicates whether the map was imaged from the right (R) side or the left (L) side of the aircraft.
CCRP_ROW	Number of row containing the CCRP
CCRP_COL	Column containing the CCRP
Aircraft Position:	
ACFT_LOC	The aircraft position at the GMT of the Patch. The format ddmmss.ssX represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y = E for east or W for west.
ACFT_ALT	The aircraft altitude in feet above mean sea level (MSL) at the GMT of the Patch.
CCRP Unit Basis Vector:	
C_AZ_NC C_AZ_EC C_AZ_DC C_AL_NC C_AL_EC C_AL_DC	The computations of patch parameters are based on a rectangular coordinate system at the current patch CCRP. The unit basis vectors for this local coordinate system are the range, azimuth and altitude vectors. The range vector points in the range direction away from the aircraft; the azimuth vector points in the cross range direction, and subtends an acute angle with the directed scene track; and the altitude vector points straight up. The variables are given as real numbers and are referred to a North, East, Down coordinate system whose origin is at the scene entry point. These data have meaning in Search scenes only.

5.1.7 ACFTA — Aircraft Information

The format for the user defined fields of the ACFTA extension is detailed in Table 16, and the descriptions of these fields is detailed in Table 17.

Table 16. ACFTA — Aircraft Information extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	ACFTA	n/a	R
CEL	Length of Entire Tagged Record	5	00132	Bytes	R
The following fields define ACFTA					
AC_MSN_ID	Aircraft Mission Identification	10	Alphanumeric		R
SCTYPE	Scene Type	1	C,R,space C = Collection Plan R = Retasked space = Immediate, or Unplanned		R
SCNUM	Scene No.	4	0000 to 9999		R
SENID	Sensor ID	3	Alphanumeric		R
PATCH_TOT	Total No. of Patches	4	Spot: 0001 Search: 0001 to 0999		R
MTI_TOT	Total Number of MTI Packets	3	000 to 120		R
PDATE	Processing Date	7	DDMonYY		R
IMHOSTNO	Immediate Scene Host	3	000 to 511		O
IMREQID	Immediate Scene Request Id	5	00000 to 32767		O
SCENE_SOURCE	Scene Source	1	0 to 6		O
MPLAN	Mission Plan Mode	2	01 to 13		R
ENTLOC	Entry Location	21	ddmmss.ssXdddmmss.ssY		R
ENTALT	Entry Altitude	6	-01000 to +30000	ft.	R
EXITLOC	Exit Location	21	ddmmss.ssXdddmmss.ssY		O
EXITALT	Exit Altitude	6	-01000 to +30000	ft.	O
TMAP	True Map Angle	7	000.000 to 180.000	degrees	R
RCS	RCS Calibration Coefficient	3	040 to 080		O
ROW_SPACING	Row spacing	7	00.0000 to 99.9999	ft	R
COL_SPACING	Column spacing	7	00.0000 to 99.9999	ft	R
SENSERIAL	Sensor Serial No.	4	0001 to 9999		O
ABSWVER	Airborne SW Version	7	vvvv.rr		O

Table 17. ACFTA — Aircraft Information field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
AC_MSN_ID	Name of the Mission.
SCTYPE SCNUM	Scene Type & Number identifies the current scene, and is determined from the mission plan, except for immediate spot scenes, where it has the value 0. The scene number is only useful to replay/regenerate a specific scene; there is no relationship between the scene number and an exploitation requirement.
SENID	Sensor ID
PATCH_TOT	Total Number of Patches contained in this file, and therefore the number of PATCHA extensions.
MTI_TOT	Total Number of MTIRPA extensions contained in this file. Each MTIRPA identifies 1 to 256 moving targets.
PDATE	The Processing Date is the day, month and year that the raw data is converted to imagery.
IMHOSTNO IMREQID	Only valid for immediate scenes. Together they will denote the scene that the immediate was initiated from and can be used to renumber the scene, Example: If the immediate scene was initiated from scene number 123 and this is the third request from that scene, then the scene number field will be zero, the immediate scene host field will contain 123 and the immediate scene request id will contain 3. The scene can then be redesignated as scene 123.3 or converting three to an alpha character the scene can be referred to as 123C.
SCENE_SOURCE	The Scene Source indicates the origin of the request for the current scene. 0 = Preplanned 1 = Scene Update (uplink) 2 = Scene Update (Manual) (Via pilot's cockpit display unit) 3 = Immediate Scene (Immediate Spot or Search Range Adjust) 4 = Spare 5 = Preplanned Tape Modification 6 = SSS
MPLAN	The Mission Plan Mode describes the current collection mode. 1 = Search 2 = Spot 3 4 = Spot 1 7 = Continuous Spot 3 8 = Continuous Spot 1 9 = EMTI Wide Frame Search 10 = EMTI Narrow Frame Search 11 = EMTI Augmented Spot 12 = EMTI Wide Area MTI (WAMTI) 13 = Monopulse Calibration
ENTLOC ENTALT EXITLOC EXITALT	In the Search mode, the entry and exit locations are the specified latitude, longitude and altitude above mean sea level (MSL) of the planned entry and exit points on the scene centerline. In the Spot mode, the entry location is the specified Spot center latitude/longitude/altitude, and the exit location is not used. The format ddmmss.ssX represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y = E for east or W for west.. The altitude is expressed in feet.
TMAP	In Search modes, the true map angle is the angle between the scene center line to the ground projection of the antenna look vector expressed in degrees. In Spot modes, the true map angle is the angle between a line through the CCRP parallel to the aircraft desired track heading to the ground projection of the vector from the aircraft to CCRP. This angle is always positive.
RCS	Performance calibration value for sensor equipment.
ROW_SPACING	Ground plane distance between corresponding pixels of adjacent rows.
COL_SPACING	Ground plane distance between adjacent pixels within a row.
SENSERIAL	Sensor (Receiver/Exciter) Serial Number
ABSWVER	Version (vvvv) and revision (rr) numbers for the airborne software.

5.1.8 PATCHA — Patch Information

The format for the user defined fields of the PATCHA extension is detailed in Table 18, and the descriptions of these fields is detailed in Table 19. A search scene typically consists of many abutting patches; each patch of the scene may be treated as an independant image and placed into a separate file, or the multiple patches (up to 999) of a scene may all be placed into a single file. There will always be 1 patch per file in spot mode. PATCHA occurs once for each patch, and is placed in the Image Subheader containing the described patch.

Table 18. PATCHA — Patch Information extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	PATCHA	n/a	R
CEL	Length of Entire Tagged Record	5	00115	Bytes	R
The following fields define PATCHA					
PAT_NO	Patch number	4	0001 to 0999		R
LAST_PAT_FLAG	Last Patch of Search Scene	1	0,1		O
LNSTRT	Start line number for this patch	7	0000001 to 9999999		R
LNSTOP	End line number for this patch	7	0000200 to 9999999		R
AZL	Number of Azimuth Lines	5	00200 to 99999	lines	R
NVL	Number of valid azimuth lines	5	00200 to 99999	lines	O
FVL	First Valid Line	3	001 to 681		O
NPIXEL	No. of image pixels per line	5	Spot: 00170 to 02720 Search: 00272 to 08160	pixels	R
FVPIX	First Valid Pixel	5	Spot: 00001 to 02551 Search: 00001 to 07889		R
FRAME	Spot Frame Number	3	001 to 512		O
GMT	Greenwich Mean Time	8	00000.00 to 86399.99	seconds	R
SHEAD	Scene Heading	7	000.000 to 359.999	degrees	R
GRAVITY	Local Gravity	7	31.0000 to 33.9999	ft/sec^2	R
INS_V_NC	Ins Platform Velocity, North	5	00000 to 99999	ft/sec	R
INS_V_EC	Ins Platform Velocity, East	5	00000 to 99999	ft/sec	R
INS_V_DC	Ins Platform Velocity, Down	5	00000 to 99999	ft/sec	R
OFFLAT	Geodetic Latitude Offset	8	±80.0000	seconds	R
OFFLONG	Geodetic Longitude Offset	8	±80.0000	seconds	R
TRACK	Track Heading	3	000 to 359	degrees	R
GSWEEP	Ground Sweep Angle	6	000.00 to 120.00	degrees	R
SHEAR	Patch Shear Factor	8	0.850000 to 1.000000		R

Table 19. PATCHA — Patch Information field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PAT_NO	Patch Number. Patches are numbered consecutively for a scene within a file, starting with patch 1.
LAST_PAT_FLAG	Flag to indicate that this patch is the last in a search scene. When all patches of a scene are not contained within a single file, PATCH_TOT in ACFTA cannot indicate the total number of patches in the scene; this flag then makes it clear that the scene ends with this patch. 0 = Not End, 1 = End.
LNSTRT LNSTOP	Absolute starting and ending line numbers of this patch within an overal image (scene). Provides similar information to ILOC in the image subheader, but in a form more suitable for some operations. Identifies specifically where this patch fits relative to the other N patches comprising an overall scene, whereas relative values in ILOC are referenced to the object to which this patch is attached.
AZL	This variable indicates how many lines are in the current patch. In Search Mode, each patch consists of from 200 to 1600 azimuth lines. Because the number of lines is a constant in the Spot mode, this variable is set to 2,720.
NVL FVL	The Spot mode frame dimensions are 2,720 azimuth lines by 2,720 range pixels. In the Continuous Spot mode, the Spot scene does not always completely fill the frame. Therefore, these variables together describe the location of the valid imagery within the 2,720 azimuth lines transferred. These variables have no meaning in the Search mode.
NPIXEL	No. of image pixels per line
FVPIX	The First Valid Pixel Index defines the location of the first pixel on a line. This variable, with the number of pixels per line, will define the location of the image within the 8,160 pixels per line for search and 2,720 for spot.
FRAME	In Continuous Spot Mode, each image about the same Map Center (a single scene) is called a Frame. The Frame Number starts at 1 and is incremented by 1 for each frame of the scene. Contains spaces for Search and Single Spot modes.
GMT	The Greenwich Mean Time (GMT) is the time in seconds (accurate to 0.01 seconds) of the start of the current patch or, in the case of Spot, the current scene or frame. GMT uses a 24 hour clock where a value of 0 corresponds to 2400 hours.
SHEAD	The Scene Heading is a variable which references the scene to True North. In Search scenes, it is the angle from True North to the Scene Center Line. In Spotlight Scenes, it is the angle from True North to the Azimuth Vector.
GRAVITY	The local gravity is the acceleration due to gravity. The units are in feet/sec^2.
INS_V_N INS_V_E INS_V_D	The Inertial Navigator Platform velocity is given in a North, East, Down earth-fixed coordinate system. The measurements are given in units of feet/second. These parameters are valid at the time specified by GMT.
OFFLAT OFFLONG	The Geodetic Latitude/Longitude Offset is the accumulated latitude/longitude correction currently being used to correct the Inertial Navigation System (INS) aircraft position outputs. The offset is given in seconds of a degree; North/East is positive.
TRACK	The track heading is measured in degrees relative to true North. The measurement is clockwise about the vertical from North to the projection of the aircraft roll axis into the level plane, and is valid at the time specified by GMT.
GSWEEP	The ground sweep angle is determined by the required azimuth resolution and is the angle over which phase history is collected. The measurements are given in degrees.
SHEAR	Targets are imaged in the slant plane determined by the Processing Central Reference Point and the SAR velocity vector at mid-array. The conversion from target spacing in the ground plane to target spacing in the slant plane for each patch allows the optimal matching of terrain features in one patch to those in the next.

5.1.9 MTIRPA — Moving Target Report

The format for the user defined fields of the MITRPA extension is detailed in Table 20, and the descriptions of these fields is detailed in Table 21.

Table 20. MTIRPA — Moving Target Report extension format

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MTIRPA	n/a	R
CEL	Length of Entire Tagged Record	5	00072 to 08742	Bytes	R
The following fields define MTIRPA					
MTI_DP	Destination Point	2	01 to 99		O
MTI_PACKET_ID	MTI Packet Id Number	3	001 to 120		R
PATCH_NO	Patch Number	4	001 to 0999		R
WAMTI_FRAME_NO	WAMTI Frame Number	5	00001 to 32767		O
WAMT1_BAR_NO	WAMTI Bar Number	1	1 to 7		O
GMT	Greenwich Mean Time	8	00000.00 to 86399.99	seconds	R
SQUINT_ANGLE	Squint Angle	5	± 60.0	degrees	O
COSGRZ	Cosine of Grazing Angle	7	0.00000 to 1.00000		R
NO_VALID_TGTS	Number of Valid Targets	3	001 to 256		R
TGT_1_LOC	Target Location	21	ddmmss.ssXdddmmss.ssY		R
TGT_1_VEL_R	Target Radial Velocity	4	± 200	feet/sec	O
TGT_1_SPEED	Target Estimated Ground Speed	3	000 to 200	feet/sec	O
TGT_1_HEADING	Target Heading	3	000 to 359	degrees	O
TGT_1_AMPLITUDE	Target Signal Amplitude	2	00 to 15		O
TGT_1_CAT	Target Category	1	H,T,U,W		O
…	…	…	…	…	
TGT_256_LOC	Target Offset	21	ddmmss.ssXdddmmss.ssY		C
TGT_256_VEL_R	Target Radial Velocity	4	± 200	feet/sec	C
TGT_256_SPEED	Target Estimated Ground Speed	3	000 to 200	feet/sec	C
TGT_256_HEADING	Target Heading	3	000 to 359	degrees	C
TGT_256_AMPLITUDE	Target Signal Amplitude	2	00 to 15		C
TGT_256_CAT	Target Category	1	H,T,U,W		C

Table 21. MTIRPA — Moving Target Report field descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
MTI_DP	Destination Point at which the scene was collected.
MTI_PACKET_ID	MTI Packet Id Number
PATCH_NO	The number of the patch within which the targets of this report were located.
WAMTI_FRAME_NO	The number of the Frame within which the targets of this report were located. This field is only used with the Wide Area MTI mode.
WAMT1_BAR_NO	The number of the Wide Area Bar within which the targets of this report were located. This field is only used with the Wide Area MTI mode.
GMT	Time in seconds past midnight GMT when the targets identified in this report were scanned by the sensor.
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from 0 (broadside) to +60 degrees; aft looking squint angles range from 0 to -60 degrees.
COSGRZ	Cosine of the Graze Angle is computed by dividing the ground plane range of the CCRP to the antenna at mid collection array (RGM) by the slant range of the CCRP to the antenna at mid array (RSM). cos (psi) = RGM/RSM
NO_VALID_TGTS	Number of MTI targets contained in this extension. Determines the number of occurrences of TGT_n_LOC, TGT_n_VEL_R, TGT_n_SPEED, TGT_n_HEADING, TGT_n_AMPLITUDE, and TGT_n_CAT fields.
TGT_n_LOC	Target Location. The format ddmmss.ssX represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y = E for east or W for west.
TGT_n_VEL_R	Target Radial Velocity in feet per second. A positive value indicates target n is moving away from the sensor, and a negative value indicates target n is moving toward the sensor.
TGT_n_SPEED	Target Estimated Ground Speed in feet per second of the nth moving target.
TGT_n_HEADING	Direction that the nth target is moving, rounded to the nearest degree and referenced to True North. 0 = North, 90 = East, 180 = South, and 270 = West.
TGT_n_AMPLITUDE	Relative signal strength (0 - 15) of the return for the nth moving target. A value of 0 indicates a target with a very weak return signal while a value of 15 indicates a moving target with a very strong return signal; intermediate values are scaled accordingly. Provides a coarse indication of relative size of the moving target.
TGT_n_CAT	Target classification category of the nth moving target: H = Helicopter T = Tracked U = Unknown W = Wheeled

6.0 NOTES

6.1 Subject Term (key word) Listing

Airborne Imagery

Moving Target Information

MTI

National Imagery Transmission Format

NITF

SAR

Synthetic Aperture Radar